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If from the living sharks we pass to the fossils, we have still other modes of teething. We find in some of them instead of distinct teeth plates covering the jaw, only three plates on each half of each jaw. These plates are conical; that is, pointed along the margin and broader inward. The teeth increase by curving the point over the jaw while the inner margin is gradually enlarging. The triangular pointing of the teeth accounts for the increased dimensions of the teeth from the young to the adult.

We have one further step where the teeth, instead of being only laid down on the surface of the jaw, are actually incorporated with it, so soldered with it that between the jaw and teeth there is hardly any difference recognizable.

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## THE WILD CATTLE OF SCOTLAND, OR WHITE FOREST BREED.

BY E. LEWIS STURTEVANT.

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ACCORDING to our best authorities two forms of the ox tribe, the genus *Bos*, existed in Scotland at an early period, *Bos primigenius* and *B. longifrons* of Owen. The former was of large size, and according to all accounts the color was black; it had white horns with long black points, the hide was covered with hair shorter and smoother than in the tame ox, but on the forehead long and curly. From the skeletons preserved in our museums the length of this gigantic ox must have been from eleven and one-half to twelve feet, and the height at the shoulders about six or six and one-half feet.\* Darwin remarks that the Pembroke race in England closely resembles this ox in essential structure, and that the cattle at present existing in the Chillingham Park are degenerate descendants of this breed.† *Bos longifrons*, on the contrary, is described as a distinct species, of small size, short body and fine legs. It was domesticated in England during the Roman period.‡ Professor Owen thinks it probable that the Welsh and Highland cattle were descended from this species.§

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\* Nilsson, *Annals and Mag. of Nat. Hist.*, 1849, iv, 258.

† *Animals and Plants under Domestication*, i, 103.

‡ *British Pleistocene Mammalia*, p. xv.

§ *Animals and Plants under Dom.*, i, 104.

A continuous range of enormous forests covered the whole extent of the country in prehistoric times, while the gigantic and fierce cattle roamed through the chase,\* and fed on the tender branches and buds, the catkins of birch, hazel, willow, and other species of willow,† resembling in this matter of feeding the moose of the Canadian forests. We have reason to suppose that the ancient islanders introduced the rudiments of a pastoral life, while yet living in pits inclosed with boughs and skins,‡ yet no evidence leads to the conclusion that the native Britons had domesticated the great oxen of the country, although undoubtedly they formed a source of food.§ In Switzerland, on the contrary, the lake dwellers had succeeded in taming these formidable brutes.||

We have it stated by Darwin, that *Bos primigenius* existed as a wild animal in Cæsar's time.¶ There is a record of white cattle in the tenth century, resembling those in the Scottish parks, existing in Wales, where they were more valued than black cattle.\*\* Boethius, in 1526, mentions them as then existing near Stirling. "At this toun began the grit wod of Calidon. This wod of Calidon ran fra Striveling throw Menteith and Stratherne to Atholl and Lochquabir, as Ptolome writtis in his first table. In this wod wes sum time quhit bullis, with crisp and curland mane, like feirs lionis, and thocht thay semit meek and tame in the remanent figure of thair bodyis, thay wer mair wild than ony uthir beistis, and had sic hatrent aganis the societe and company of men that thay come nevir in the wodis, nor lesuris quhair thay fand ony feit or haind thairof, any mony dayis eftir, thay eit nocht of the herbis that wer twichit or handillit be men. Thir bullis wer sa wild, that thay wer nevir tane but slight and crafty laubour, and sa impacient that eftir thair taking they deit for importable doloure. Also sone as ony man invadit thir bullis, they ruschit with so terrible preis on him, that they dang him to the eird, takand na feir of houndis, scharp lancis, nor uthir maist penetrive wapinnis." "And thought thir bullis were bred in sindry boundis of the Calidon wod, now, be continwal hunting and lust of insolent men, thay are distroyit in all partis of Scotland, and nane of thaim left bot allanerlie in

\* Prehistoric Scotland. Wilson's. † Nilsson, An. & Mag. of Nat. Hist., 1849, iv, 269.

‡ Prehistoric Scotland, i, 296. § Prehistoric Scotland, i, 31.

|| Lyell's Antiq. of Man. Phila., 1863. p. 24.

¶ Animals and Plants under Domestication, i, 104. \*\* Low's Animals, 239.

Cumarnauld.”\* In a remarkable document, written about 1570, the writer complains of the aggressions of the King’s party in the destruction of the deer in the forest of Cumbernauld, “and the quhit ky and bullis of the said forest, to the gryt destructione of policie and hinder of the commonweill. For that kynd of ky and bullis he bein kept thir money zeiris in the said forest, and the like was not mantenit in ony vther partis of the Ile of Albion.”† In 1598, John Leslie, Bishop of Ross, speaks of the wild ox occurring in the woods of Scotland, of a white color, with a thick mane, resembling a lion’s, and wild and savage. He says that it had formerly abounded in the Sylva Caledonia, but was then only to be found at Stirling, Cumbernauld, and Kincardine.‡ Sandford, in his manuscript history of Cumberland, dated 1675, says around Naworth formerly were “pleasant woods and gardens; ground full of fallow deer, fieding on all somer-tyme; brawe venison pasties, and great store of reid deer on the mountains; and white wild cattle, with black ears, only on the moores.”§ We find them referred to by Bewick in 1770, and in 1781 Pennant speaks of them as retaining their white color, but as having lost their manes. || Conrad Gesner describes them as “white oxen, maned about the neck like a lion. . . . This beast is so hateful and fearful of mankind, that it will not feed of that grasse or those hearbes whereof he savoureth a man hath touched—no, not for many days together; and if, by art or policy, they happen to be taken alive, they will die with very sudden grief. If they meet a man, presently they make force at him, fearing neither dogs, spears, nor other weapons.” (16th century; quoted from Scherer’s *Rural Life*, p. 627.)

“Here (Cadzow Castle), so late as the year 1760, were a few of those white cattle with black or brown ears and muzzles, once so common in Scotland. Their shyness and ferocity of temper rendered them troublesome and of little use, they were therefore exterminated in the year above mentioned.” (*The History of the City of Glasgow, etc.*, by James Denholm. Glasgow, 1798, p. 252.)

\* Hector Bosce, born in 1470. *Hist. Scotorum*, pub. at Paris, 1526, ed. of 1574, fol. 6, line 63, occurs the passage quoted in *An. & Mag. of Nat. Hist.*, 1839, ii, 281, and *Low’s Animals*, 234.

† *Illustrations of Scottish History*, preserved from manuscripts by Sir John Graham Dalyell, Bart., quoted in *Low’s Animals*, p. 235.

‡ Leslie. *De Origine Moribus et Rebus Gestis Scotorum*. Rome, 1598, ed. of 1675, 18, quoted in *An. & Mag. of Nat. Hist.*, 1839, ii, 282. Also in *Low’s Animals*, 234.

§ *Jour. R. A. S.*, 1852, xiii, 249. || *Quadrupeds*, 16.

About 1800 they are spoken of as invariably white, with the ears internally, and externally about one-third down, red; horns white, tipped with black, and the muzzles black.\* In 1836, we begin to get more particular descriptions. Color invariably white, muzzle black, the whole of the inside of the ear, and about one-third of the outside, from the tip downward, red. The horns are very fine, white with black tips; and the head and legs are slender and elegant.† The Earl of Tankerville, the proprietor of Chillingham park, describes them in 1839. In form they are beautifully shaped, with short legs, straight back, horns of a very fine texture, as also their skin so that some of the bulls appear of a cream color.‡ In 1845, Low says that the eyelashes and tips of the horns are black, the muzzle brown, the inside and a portion of the external parts of the ears are reddish-brown, and all the rest of the animal white. The bulls have merely the rudiments of manes, consisting of a ridge of coarse hair upon the neck.§ In 1852, William Dickinson says that their bodies are pale cream color, the ear tips red and the muzzle black.|| In 1868, Darwin describes them as white with the inside of the ears reddish-brown, eyes rimmed with black, muzzle brown, hoofs black, and horns white tipped with black.¶ Youatt mentions the existence of a mane on some of the bulls, one and one-half or two inches in length.\*\*

As a wild race we hear of their occurrence at rare intervals. In the time of Edward the Confessor (1042), we are told by one of the abbots of St. Albans that wild bulls abounded near London,†† and Fitz-Stephen writing about 1174, speaks likewise of their occurrence in these woods.‡‡ In 1760, wild white cattle were just extinct in the central Highlands.§§ In 1598, their occurrence in Scotland was confined to but a few localities.|||| We are thus particular in tracing the accounts of this breed, as Wilson maintains that no sufficient evidence has ever been brought forward to prove that these cattle are entitled to the character of an aboriginal breed.¶¶ Of the remnants of this ancient race, we have two herds, at least, existing at the present time, and records of others whose extinction has been comparatively recent. The general

\* Complete Grazier, p. i. † Naturalists' Lib., Jardine, iv, 202.

‡ An. & Mag. of Nat. Hist., 1839, ii, 277. § Low's Animals, 237.

|| Jour. R. A. S., 1852, xiii, 249. ¶ An. & Pl. under Dom., 107.

\*\* Youatt & Martin on Cattle, 12. †† An. & Mag. Nat. Hist., 1st ser., iii, 356.

‡‡ An. & Mag. Nat. Hist., 1849, iv, 423. §§ Trans. H. & Ag. Soc., 4th series, v, 294.

|||| Low's Animals, 234. ¶¶ Enc. Brit., xiv, 214.

descriptions of white with colored ears apply to all, yet each herd has had its distinctive features, and we find evidence of a constant tendency to variation, only repressed by a rigorous selection.

Chillingham castle, the seat of the Earl of Tankerville, is situated in Northumberland County, England, and formerly occupied one end of the Caledonian forest, which in former times extended from sea to sea. The wild cattle have been preserved in this park with care, and kept free from intermixture with other breeds. They have been extensively inbred from necessity, "and are accordingly much subject to rash, a complaint common to animals bred in and in." We find it recorded that the stock at Chillingham was at one time left without a bull, from accident and sterility. Fortunately one of the cows had a bull calf, and the stock was preserved.\* In color, they are invariably white† or white,‡ or pale cream color§ or creamy white.|| or white and cream color.¶ Their horns are white tipped with black; their muzzle black\*\* or brown;†† their eyelashes black;‡‡ their eyes rimmed with black.§§ Their ears inwardly and about one-third externally, red,||| reddish-brown,¶¶ or red or brown.\*\*\* Their necks have rudimentary manes,††† or oftentimes a mane from one and a half to two inches long,†††† or no manes but coarse hair.§§§ Their heads slender,|||| backs straight. Legs short¶¶¶ and slender,\*\*\*\* and the hoofs black.††††

In 1675, as we have seen, they are described with black ears.†††† In 1770 according to Bewick, some calves appeared with black ears, but these were destroyed, and black ears had not since reappeared.§§§§ Since 1855 about a dozen calves have been born with brown or blue spots on their cheeks or necks, but these, with any

\* Earl of Tankerville, *Annals and Mag. of Nat. Hist.*, 1839, ii, 284. *Nat. Lib.*, Jardine, iv, 207, note.

† *Nat. Lib.*, Jardine, iv, 202, note. ‡ Darwin, *An. & Pl.*, under *Dom.*, i, 107.

§ Hindmarsh, *An. & Mag. Nat. Hist.*, 1839, ii, 279. Dickinson, *Jour. R. A. S. of Eng.*, 1852, 249.

|| Capt. Davy, *Milk Journal*, Oct., 2, 1871, 225.

¶ Earl of Tankerville, *Annals of Nat. Hist.*, 1839, ii, 277.

\*\* Dickinson, *Nat. Lib.*, Capt. Davy, *op. cit.*

†† Low, Darwin, Earl of Tankerville, *op. cit.*

‡‡ Low, Hindmarsh, *op. cit.* §§ Hindmarsh, Darwin, *op. cit.*

||| Dickinson, *Nat. Lib.*, *op. cit.* ¶¶ Low, Darwin, *op. cit.*

\*\*\* Earl of Tankerville, *Annals of Nat. Hist.*, 1839, ii, 277.

††† Low's *Animals*, p. 237. ††† Youatt and Martin on *Cattle*, p. 12.

§§§ Earl of Tankerville, *An. of Nat. Hist.*, 1839, ii, 277.

|||| Earl of Tankerville, *An. of Nat. Hist.*, 1839, ii, 284.

¶¶¶ Earl of Tankerville, *An. of Nat. Hist.*, 1839, ii, 277.

\*\*\*\* *Nat. Lib.*, Jardine, iv, 202, note. †††† Darwin, *An. & Pl. under Dom.*, i, 107.

†††† *Jour. R. A. S.*, 1852, xiii, 249. §§§§ Darwin, *An. and Pl. under Dom.*, i, 107.

other defective animals, were immediately destroyed,\* and Low speaks of the tendency of the young to be altogether black or altogether white, or to have black ears.† In Knox's "Natural History," published probably in the earlier part of the present century, these cattle are said to have lost their manes, but to have retained their color and fierceness; to be of a middle size, long legged, with black muzzles and ears, and their horns to be fine and to have a bold and elegant bend. The keeper of those at Chillingham said that the weight of the ox was thirty-eight stone, of the cow twenty-eight. It would thus seem as if Knox spoke from personal observation (vol. i, p. 55).

The Hamilton Park cattle are often referred to as the cattle of the Chase of Cadzow, after the castle of that name, the former seat of the dukes of Hamilton. Cadzow Castle occupies a site on the banks of the Avon in Lanarkshire, at one extremity of the ancient Caledonian wood. Aiton, in 1814, describes these cattle as uniformly of a creamy white color, their muzzles and the greater part of their ears black or brown, and some with a few black spots on their sides. A few are without horns, but the greater number have handsome white ones, with black tips bent like a new moon. Some of the bulls have a sort of mane, four or five inches long. The cattle at Hamilton and Ardrossan are not so fierce and savage as their ancestors, but at Auchencruive they still retain much of their natural ferocity. Their backs are high and not so straight as could be wished. Their chest is deep but narrow, and they have much the appearance of the ill-fed native breed of the cattle of Ayrshire, Lanarkshire, etc., about fifty years ago.‡ In 1845 Low describes them as with the females generally polled,§ and in 1870 the bulls are credited with black tipped horns.|| Their color is given as dun white,¶ or dingy white,\*\* their muzzle and hoofs black,†† as also the inside of the ears,‡‡ and the tongue.‡‡ In the "Naturalist's Library" we find it stated that their bodies are thick and short, their limbs stouter than the Chillingham breed, and their heads much rounder, the inside of their mouths either black or spotted with black, and the fore part of their legs, from the knee downward, mottled with black.§§ At one time but thirteen re-

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\* Darwin, An. and Pl. under Dom., i, 107. † Low's Animals, 238.

‡ Sinclair's Scotland, iii. 44. § Low's Animals, 236.

|| Gard. Chron. and Ag. Gaz., Aug. 6, 1870. ¶ Low, Nat. Lib., *op. cit.*

\*\* Dickinson, Jour. R. A. S., of Eng. 1852, 249. †† Low, Nat. Lib., *op. cit.*

‡‡ Low's Animals, 236. §§ Nat. Lib., Jardine, iv, 202, note.

mained alive, the survivors of the cattle plague of the few years previous. The bulls looked as if they might fatten to eight hundred or eight hundred and fifty pounds. They had light hind quarters but were heavy and deep in front; all had black muzzles, black ears, and the older beasts black tips to their horns.\* We were told that some years ago the herd numbered eighty or ninety, but all fell victims to the cattle plague, except thirteen, of which eleven altogether escaped and two recovered. When the plague attacked them, they were driven individually between gradually approaching fences, leading to a large and strong wagon sunk to the ground level, and so captured, and taken to separate abodes, where they were confined until all risk was passed. They have now (in 1870) increased to thirty-seven.†

We have mention of some having been kept at Ardrossan and Auchencruive, but no further particulars, except that those at the latter place were very fierce.‡ They were also kept at Bishop-Auckland in 1635.§

The cattle preserved at Drumlanrig, the seat of the Duke of Queensberry, are said by Darwin to have become extinct in 1780, and are described as with their ears, muzzle and orbits of the eyes black.|| Pennant writing in 1781 speaks of them as still existing, having lost their manes, but of a white color.¶ Dickinson states that two cows and a bull were living in 1821, but the bull and one of the cows died that year. He describes them as dun or rather flea-bitten white, polled, with black muzzles and ear tips, with spotted legs.\*\* Low says they were destroyed many years ago by order of the late Duke of Queensberry.

The cattle at Gisburne Park, in Craven, County of Yorkshire, England, the seat of Lord Ribblesdale, are mentioned, as late as 1852, as being pure white with brown or red ears and noses.†† Low speaks of their being polled,‡‡ and Bewick describes them as perfectly white except the inside of their ears which are brown. They are without horns, very strong boned but not high.§§ He also states, as Darwin quotes, that they are sometimes without

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\* Gard. Chron. and Ag. Gaz., Aug. 6, 1870. † Gard. Chron. and Ag. Gaz., Aug. 6, 1870.

‡ Sinclair's Scotland, iii, 44. § An. Nat. Hist., vol. iii, ser. 1, p. 241.

|| Darwin, An. and Pl. under. Dom., i, 107. ¶ Quadrupeds, 16.

\*\* Dickinson, Jour. R. A. S. of Eng., 1852, 249.

†† Dickinson, Jour. R. A. S., 1852, 249.

‡‡ Low's Animals, 238.

§§ Bewick's Quadrupeds, 8th edit., 39, note.



dark muzzles.\* They are said to have been originally brought from Whalley Abbey, in Lancashire; upon its dissolution in 1542.†

The herd at Burton Constable, also in Yorkshire, situated in the district of Holderness, all perished in the middle of the last century of an epidemic disorder. They were of large size, and had the ears, muzzle and tip of the tail, black.‡

At Chartley Park, in Staffordshire, England, the property of Lord Ferrers, Low states that a herd exists, resembling those at Chillingham, but of larger size, and having the muzzles and ears black. He also adds that they frequently tend to become entirely black. This herd is very ancient, having existed in this park from time immemorial.§

Wild cattle, says Low, have been or are yet preserved at Wolaton in Nottinghamshire and at Limehall in Cheshire, England,|| and Bewick states that the ears and nose of all of them are black.¶

These cattle, in the possession of ancestral families, and maintained and protected in parks, undoubtedly as a family pride, have with difficulty been preserved through the epidemics and casualties of a few centuries. Yet, despite the human care and the rigorous weeding out of blemishes, we can see they were unable to retain in their color or form much more than a resemblance. In the Chillingham cattle the muzzle is described as black or brown, the ears inwardly, and in part externally, red, reddish-brown and red or brown. Their manes either short, or rudimentary, or not existing. We find black ears and blemishes occurring at different times. In the Hamilton herd we find them generally with horns at an early date, but afterwards the females usually polled. Black spots on sides and legs are noticed. They are described as possessing manes of from four to five inches long, especially some bulls. Their limbs have become stouter and their heads shorter than the Chillingham breed at the other end of the ancient wood. Those at Drumlanrig have become polled, presumably in both sexes. At Gisburne Park, they are not only hornless, but only the inside of their ears are colored, and occasionally they lose their dark muzzle. At Burton Constable, among their fertile pastures, we see an increase of size, the effect of the abundance of the feed, and the ends

\* An. and Pl. under Dom., i, 108. † Bewick's Quadrupeds, 8th edit., p. 39, note.

‡ Low's Animals, 238. § Low's Animals, 238. || Low's Animals, 238.

¶ Bewick's Quadrupeds, 8th edit., 39, note.

of the tail have become black. In Staffordshire, we observe the tendency to become entirely black.

When even selection finds it so difficult to preserve the uniformity of the same herd for successive years, and fails even more glaringly when applied to different herds under varied circumstances, we can hardly be justified in rejecting these white cattle as the primitive or foundation stock of existing breeds of that county on account of their color alone.

The wild state seems peculiarly favorable to uniformity of coloring, as the causes which have operated to produce the result on a few act likewise upon all, and are constant in their action. Any deviations from the markings appear to become absorbed in the multitude, so as to have little opportunity for preservation. In civilization, on the contrary, we have the element of human will, a highly complex and variable possession, which interrupts the apparent harmony of uncultured nature, by rendering new combinations possible and probable. That a slight interference with a natural state will produce variability of coloring is well shown in an account of the cattle of Paraguay by Azara, wherein it is stated that the wild cattle are always a reddish pard color, and thus differ in color from the domesticated breeds.\* When it is considered how little tameness is called domestication in these regions, it is realized upon what obscure causes the fact of color must depend. Even in our most ancient breeds we find variations of color, as in the Highland, Galloway and Devon.† The strongest single argument in favor of these white cattle being the forefathers of our present stock, is in the occasional cases of reversion, which occur in many of the breeds, and oftener in those whose connection with the wild breed seems probable. In the West Highland breed, usually black, the white color and the ear markings in many cases return.‡ In the Ayrshire cow I have record of two cases of reversion to white with red ears, and I can remark, after a most careful examination of Ayrshire cows, that I have never seen white ears, or ears the tips of which were other than red, brown or black. In shape we have the differences inherent to locality. Mountain breeds are apt to be lighter in their hindquarters than breeds occupying a plain, as we are told by Low,§ and it is obvious to any observer that semi-domesticated breeds are lighter in the flanks

\* Nat. Hist. of the Quadrupeds of Paraguay, Edinb., 1838, 73.

† Low, *passim*. ‡ Low's Animals, 301. § Low's Animals, 305.

and loins, than those breeds which have been subjected to systematic breeding. In the Ayrshire breed we find the medium horn, often the direction of the curve and the frequent black tip pointing to the wild breed, as also the white face, or starred forehead, and the "rigged" back occasionally or frequently recurring, to direct our attention to the transition cattle between the original stock, and the recorded results of breeding, coeval with the advanced interest in agricultural pursuits at or about 1800.

These cattle in their present state are easily and readily tamed and crosses with common stock are occasionally noted. Such with the forest bull are said by Bewick to invariably take the color of the father and to retain some of the fierceness.\* The recorded instance of the crossing of a cow of the white breed by a common bull gives the color of the progeny as after the forest pattern, but with mottled legs.†

When we consider the small number of these cattle, and the length of time they have been preserved, and how narrowly they have escaped utter extinction, it is difficult to suppose that they have been retained in their purity; still less when we consider the disturbances of the times, the number of cattle grazing continually in their vicinity, and the striking resemblance which is often shown to them by cattle of other breeds. According to Low, individuals were to be met with in 1845, in the county of Pembroke, in no ways distinguishable from the wild cattle of the Parks,‡ and Aiton speaks of their resemblance to the common cattle of 1750. I have myself seen in America, cattle which were pure white with red ears, and even polled.

The only explanation which I can see for the variations between the herds of forest cattle and the tendency towards variation, which seems from our account to have been ever strong, is that these, as well as the domestic cattle of those regions, are offshoots from the same original stock, the wild ox of the past, but that those races we call domesticated, as the Ayrshire, the Angus, the Galloway, the Highland and others, have been influenced to a greater extent by the arts of civilization, the conscious or unconscious breeding for certain uses, and the effects of crossing, than these inhabitants of the parks.

On this view the White Forest Breed is a wild animal, a descend-

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\* Bewick's Quadrupeds, 41, note.

† Hindmarsh, Ann. and Mag. of Nat. Hist., 1839, ii, 250. ‡ Animals, 296.

ant, with now and then a bar sinister, of the wild breed, and the domesticated races of the country are likewise their descendants, but with an ancestry hopelessly confused and intermixed by outside crosses and influences.

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## EXPLORATION OF THE GULF OF MAINE WITH THE DREDGE.

BY A. S. PACKARD, JR.\*

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THOUGH it was the original intention to devote the month to an exploration of George's Bank, it was decided on account of the "Bache's" defective boilers to work nearer shore and extend farther from land the work of the U. S. Fish Commission, for the season located in Casco Bay; the dredging operations being conducted under the charge of Professor Verrill. This involved an examination of certain unexplored portions of that great indentation lying between Cape Sable, Nova Scotia, and Cape Cod, and which is laid down on the charts as the "Gulf of Maine."

Through the researches of Messrs. Stimpson, Verrill, myself and others in the Bay of Fundy, and of Drs. Gould, Wheatland, Stimpson and others in Massachusetts Bay, together with the very thorough examination of Casco Bay and vicinity pursued during the past summer by Professors Baird and Verrill, we had attained a very complete knowledge of the coast fauna of New England north of Cape Cod. Moreover, the explorations of George's Bank made by Messrs. Smith, Harger and myself last year in the "Bache," had given us some idea of the nature of the sea bottom there, dredging having been carried on at a depth of four hundred and thirty-two fathoms by Messrs. Smith and Harger, and in one hundred and fifty fathoms by myself.

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\*Report of Explorations with the Dredge on the U. S. Coast Survey Steamer "Bache," in the Gulf of Maine, during September, 1873; under the direction of Prof. Baird, U. S. Fish Commissioner, made to the Superintendent of the Coast Survey and to the U. S. Commissioner of Fisheries. In all the work I had the invaluable aid of Mr. C. Cooke, with his great experience in dredging, and owe much to the ready aid and sympathy of Commander Howell, Executive Officer W. H. Jaques, and Lieuts. Hagerman, Jacob, Rush, Bradbury, and Dr. Dickson. Samples of bottom water were taken up at nearly every station, the metal water bottle being used. For the identification of the specimens I am indebted to Professor Verrill.